CHAPTER ELEVEN: PROJECTED BUDGET

11.1 INTRODUCTION

The management goal of the Pinal Active Management Area (PAMA) is to allow development of non-irrigation uses and to preserve the existing agricultural economy for as long as feasible, consistent with the necessity to preserve water supplies for non-irrigation uses. Monitoring the cumulative impact of demand on the aquifer is critical in identifying the PAMA's success toward achieving the goal. The Arizona Department of Water Resources (ADWR) uses this information to evaluate whether additional tools are necessary to assist the PAMA in achieving its goal.

Water demand and supply projections as well as water budget scenarios are prepared based on many assumptions and are some of the tools used to evaluate whether the PAMA is meeting its goal. As discussed and described in Chapter 3, since the publication of the *Demand and Supply Assessment, Pinal Active Management Area* (Assessment) (ADWR, 2011), ADWR's Hydrology staff has developed revised historical natural recharge components and subsequently modified the projected natural recharge components in the water budgets. In the Assessment, long-term averages of stream channel and mountain front recharge were used and it was determined that method masked the annual variability and uncertainty of net natural recharge. These are important characteristics to consider so the modifications will result in improved water management decisions in the PAMA.

The projection years in the *Fourth Management Plan for Pinal Active Management Area* (4MP) are from 2016 through 2040, and incorporate the actual historical natural recharge components. The 4MP includes one scenario based on normal delivery of Central Arizona Project (CAP) water (Normal Delivery Scenario) and one scenario with a Tier 1 (320,000 acre-foot) reduction (Tier 1 Shortage Scenario) occurring almost every year in the projected period. In taking this approach, ADWR is not projecting nor predicting that there will be a Tier 1 reduction every year in the future; rather, it is intended as a conservative approach to evaluate shortage impacts on the PAMA. The probability of shortage depends on many factors, including the volume of Colorado River water used on-river, changes in CAP customer water ordering patterns, the availability of alternative water supplies, water conservation efforts, and the impact of rate increases (Central Arizona Project, 2015). Other factors can include climate variability and the timing, volume, and location of precipitation. These factors are not constant, but vary every year and some are simply unknown. Additionally, the way these factors interact is not always clear and there may be other factors that have not yet been identified. All of these factors and conditions result in a multitude of probable volumes of available CAP water in the future.

It is important to note that the US Geological Survey (USGS) indicates that "a statement of probability is not a forecast," and describes probability as "analysis of the variability of a sample" (Luna B. Leopold, 1959). In 2014, the Arizona Water Banking Authority (AWBA), ADWR and the CAP published a joint plan for the recovery of AWBA long-term storage credits which could occur to help offset the impact of a reduction in CAP supply (AWBA, ADWR and CAP, 2014). Charts indicating the range of the probability of a reduction in CAP supplies are included in the plan, which show increasing uncertainty with time. In the book *The Signal and the Noise*, author Nate Silver describes uncertainty as "risk that is hard to measure," (Silver, 2012); this description seems appropriate regarding water demand and supply projections. The Tier 1 Shortage Scenario is included to give an idea of the potential impact of an extended shortage on groundwater overdraft, but is not intended as a prediction of shortage.

For the Normal Delivery Scenario, ADWR used the May 22, 2015 CAP Delivery Schedule through the year 2040 *(See Appendix 11)*. For the Tier 1 Shortage Scenario, ADWR subtracted 320,000 ac-ft from the volume projected to be delivered from the May 22, 2015 CAP Delivery Schedule in each year from 2016 through 2040. Although 2016 was not a shortage year, ADWR projected that year as a shortage to illustrate the impact of a very long-term Tier 1 reduction for comparison purposes with the Normal Delivery Scenario. For water management planning purposes, it may be helpful to explore additional scenarios during the fourth management period. Actual CAP deliveries during the projection period of 2016 through 2040 could be more or less than these assumptions.

Further, on April 22, 2015 ADWR hosted a Colorado River Shortage Preparedness Workshop. Information presented at that workshop can be found at: *http://www.azwater.gov/azdwr/ColoradoRiverShortagePreparedness.htm*. On May 9, 2016 ADWR held a briefing on potential Colorado River allocation shortfalls (*http://www.azwater.gov/AzDWR/ADWR_News/ColoradoRiverWaterBriefing.htm*). In planning for the uncertainty and range of probability of a reduction in CAP supply, ADWR, the AWBA and the CAP are working together to help mitigate impacts of potential reductions of CAP water to water users in the CAP service area and Colorado River water users.

Population projections in the 4MP are based on Traffic Analysis Zone (TAZ) projections ADWR obtained from the Central Arizona Association of Governments (CAG) and the Maricopa Association of Governments (MAG) in the year 2014 for the Pinal County and Maricopa County portions of the PAMA which extend out to the year 2040. ADWR will update the planning water budgets on its website on a regular basis throughout the fourth management period. A summary of the projection assumptions describing ADWR's general approach is included in the section below, followed by tables showing the results of those assumptions.

The overdraft values shown in the 4MP water budget for each scenario represent PAMA-wide balances at given points in time. The fourth management period constitutes one increment of time. However, both the management plan and the water budgets are affected by the Assured Water Supply (AWS) Program requirements and need to be understood in the context of the 100-year AWS planning time frame. Many of the decisions water providers and developers will make moving into the future will be made in the context of water management needs during this 100-year time frame. Likewise, decisions ADWR makes on water management policy are framed in this larger context, including the decision to allow a certain volume of groundwater mining by water providers.

In the PAMA 4MP, ADWR incorporated updated projections from those used in the Assessment and in the legislatively mandated Water Resource Development Commission (WRDC) reports. Population projections generated by demographic agencies tend to mirror recent trends. When growth is strong, projections appear optimistic. In less robust economic times, when growth is slowed, projections tend to be lower. Water budgets used for planning purposes can be found on ADWR's website: *http://www.azwater.gov/AzDWR/WaterManagement/AMAs/FourthManagementPlan.htm*.

11.2 WATER BUDGET COMPONENTS AND SECTOR ASSUMPTIONS

Demand and supply assumptions used in both the Normal Delivery Scenario and the Tier 1 Shortage Scenario for the PAMA 4MP are as follows:

Population projections

- Population projections prepared by other agencies were used to develop a total PAMA population projection. In Pinal and Maricopa counties, the regional associations of government (CAG, MAG) projections were used.
- Population projections by TAZ were disaggregated to water provider boundaries by comparing a number of sources, including: water distribution line location data; Certificate of Convenience and

Necessity (CC&N) boundaries for private water companies; incorporated area boundaries for cities and towns; and issued determinations of AWS by provider to the TAZ boundary. TAZs with no current water provider service but significant population growth were assigned to the closest likely provider in most cases. Where a TAZ included current population but no water provider, this population was assumed to be served via privately owned (exempt) wells. An assumption was made that this exempt well population component would not grow due to the greater likelihood that the majority of growth would be served by a central distribution system.

- Small provider population within a TAZ was generally held at the proportion of the TAZ population served by the small provider in 2010 unless ADWR had information that either: 1) the small provider was not likely to grow (built out subdivision, mobile home parks that have not grown historically, etc.), or 2) the small provider had great potential to grow based on issued determinations of AWS.

Large Municipal Provider Demand and Supply

- Each large municipal provider's demand was based on an individual analysis of each provider's Gallons per Capita per Day (GPCD) trend, whether reducing, increasing, or remaining constant, carried forward to 2040. A lower limit of 200 gallons per housing unit per day (GPHUD) was set; however, no providers calculated GPCD trend resulted in a GPHUD going below 200 GPHUD in the PAMA.
- Individual assumptions were made for each large municipal provider water supply based on historical supplies used. Not all municipal providers use the same water supplies. Each provider has its own unique pattern of water supply utilization. ADWR reviewed Designation of Assured Water Supply (DAWS) files and water rights information to project water supply utilization on a provider by provider, year by year basis. CAP water supplies available can include municipal and industrial subcontracts, leased CAP water, or Non-Indian Agricultural (NIA) Priority water *(See http://www.azwater.gov/AzDWR/PublicInformationOfficer/Non-IndianAgriculturalReallocationProcess.htm)*. In addition to the pending January 17, 2014 recommendation to the US Secretary of the Interior to reallocate NIA priority water, there will be additional NIA priority reallocations during the projection period.

Small Municipal Provider Demand and Supply

- Small provider demand was projected using a trend line of the historical GPCD rate.
- Small provider supply was all groundwater.

Exempt Well Demand and Supply

- Exempt well demand was based on water use figures updated from the PAMA 3MP models for new single family homes (45 GPCD interior and 119 GPHUD exterior). The models were updated based on ADWR's review of reported water usage per lot for Central Arizona Groundwater Replenishment District (CAGRD) Member Lands and reported single family residential deliveries by month for CAGRD Member Service Areas.
- Exempt wells use all groundwater.

Industrial Demand and Supply Projections

- Industrial turf demand was projected using the logarithmic function of the historical water use, and supplies would be used consistent with those used in the past.
- There is an active mining facility in the PAMA that has not used water since 2005. However, for the projection period, ADWR assumed the mine would begin operation in 2017 and continue throughout the projected period based on information that the mine would resume operations.

- Sand and gravel production water demand was projected to remain at the historical average and supplies were projected to be used consistent with historical patterns over the same time span.
- Dairy use demand was held constant and supplies were presumed to be used consistent with the historical patterns.
- Feedlot use was projected to remain at the historical average and supplies were projected to be used consistent with historical patterns over the same time span.
- “Other” industrial water demand was projected to remain at the historical average with water supplies consistent with the historical pattern.

Agricultural Demand and Supply Projections

- Agricultural demand projections assumed
    - Some irrigation acres urbanized based on TAZ population projections within each district;
    - Non-district demand remained constant based on the historical average non-district demand;
    - Agricultural demand was projected based on information supplied by each district regarding maximum groundwater pumping limits, Groundwater Savings Facility (GSF) permit conditions, and infrastructure considerations.
- Agricultural supply was projected using information about the current water portfolios for each irrigation district. The available CAP supply was based on projected available CAP agricultural pool volume, recent use, and projected demand. The projections assume the NIA reallocation is completed and the total CAP agricultural pool water for all Active Management Areas (AMAs) is assumed to be reduced by 25 percent in 2017, and then by an additional 25 percent in 2024, reducing to zero after 2030. For the purposes of these projections, reductions were applied to each allottee based on the percentage of each allottee’s CAP supply to the full pool volume (400,000 ac-ft). GSF supply projections were based on current permits, and the projected amount of supplies available for storage and is identified as in-lieu groundwater in the 4MP. Projected demands not met by CAP, in-lieu groundwater, effluent, or surface water (the San Carlos Irrigation and Drainage District (SCIDD) is the only district that uses surface water in the PAMA) were assumed to be met by mined groundwater.

Tribal Demand and Supply Projections

- Tribal demand projections included increased demands in tribal agriculture. Generally, demand was projected based on evaluating trends in the available historical data, or by making reasonable assumptions regarding use, based on historical tribal use and information available to ADWR. Tribal municipal demand was projected based on the change in on-reservation population between 2000 and 2010 and an assumed overall GPCD rate of 57 GPCD. For the 4MP tribal agricultural demand projection, each tribe’s water use was projected individually.

    Gila River Indian Community

    A portion of the Gila River Indian Community (GRIC) lies within both the Phoenix AMA and the PAMA. ADWR assumed that the GRIC CAP water would ramp up to full utilization for agricultural irrigation in 2029, with 15 percent of the CAP volume used in the PAMA and 85 percent used in the Phoenix AMA. As with SCIDD surface water, ADWR assumed the 1995 – 2010 surface water use, provided by the San Carlos Irrigation Project, would be available. The historical average was used for GRIC groundwater. The sum of each of these supply projections equaled the total projected demand for the GRIC each year.

    Ak-Chin Indian Community

Ak-Chin demand was projected to equal 72,000 ac-ft per year of CAP water, consistent with the historical pattern.

Tohono O'odham (Chuichu and Vaiva Vo farming areas)
Demand for the portion of Tohono O'odham land within the PAMA was projected to remain at a constant 13,000 ac-ft per year of groundwater.

11.3 ADDITIONAL SUPPLY ASSUMPTIONS

The volume of groundwater projected to be used is equal to the remainder of the projected demand after renewable supplies are subtracted. Generally, ADWR assumed that CAP subcontract utilization would increase over time, that excess CAP water would correspondingly decrease over time, and that any excess CAP water would either be replenished each year by the CAGRD, or stored by the AWBA, or other excess users. Utilization of reclaimed water is assumed to increase throughout the projection period.

ADWR also assumed that increased artificial recharge of reclaimed water and continued artificial recharge of CAP water would occur. In the PAMA, the majority of recharge activity consists of CAP storage at GSFs. The amount of GSF storage is driven by the water available to store and the available storage capacity. Reclaimed water storage was projected to increase, since projected reclaimed uses keep pace with the rate of increase in reclaimed water production, and there is currently unused capacity in the PAMA's permitted reclaimed water storage facilities and limited projected new direct uses for reclaimed water in the PAMA. The projected increase in reclaimed water stored is an additional 19,000 ac-ft per year by 2040.

Natural components that result in net natural recharge used in the 4MP are different from those used in the Assessment, which assumed a long-term average of stream channel recharge and possibly gave the false impression that stream channel recharge is a long-term reliable supply. Arizona's arid climate is such that stream channel recharge is variable and can have significant peaks and periods of little or zero flow. To help simulate these naturally occurring conditions for the 4MP budgets, ADWR Hydrology staff examined the historical period of flow for the Gila and Santa Cruz Rivers and used the 1995 through 2010 historical record as generally representative of "normal" conditions. In the Assessment, net natural recharge assumptions had remained at a constant long-term average in both the "normal" and "shortage" scenarios. Riparian transpiration also varies. Riparian transpiration tracks with stream channel recharge, groundwater inflow and outflow, canal seepage, and lagged agricultural incidental recharge.

11.4 DIFFERENCES BETWEEN THE NORMAL DELIVERY SCENARIO AND THE TIER 1 SHORTAGE SCENARIO ASSUMPTIONS

Both scenarios project direct use and storage of CAP water for the three CAP AMAs in sum to avoid the possibility of double-counting the projected available CAP supply and to ensure that all CAP supply is fully utilized between the three AMAs. In the Tier 1 Shortage Scenario ADWR utilized the CAP pool priority structure to reduce CAP supplies. If the difference between the total projected CAP supply and the total projected CAP use (including storage) in any year is a positive number, the remaining amount is distributed among the three AMAs based on the proportion of the projected CAP stored in each AMA to the other AMAs. If the result is a negative number, the CAP supply is first subtracted from any unused CAP supply, beginning with the lowest priority users. The distribution of unused CAP among the three AMAs is determined based on the trend in the historical ratio of CAP storage among the three AMAs. The historical trend in the ratio of CAP water stored between the three CAP AMAs indicates a slightly increasing proportion of CAP water stored in the PAMA.

The CAP agricultural pool has the lowest priority and was designed to decline over time, until the pool no longer exists by 2030. In the Tier 1 Shortage Scenario, the 320,000 acre-foot shortage impacts the CAP agricultural pool each year of shortage, beginning in the first projected shortage year. After 2030, with no CAP agricultural pool, shortage volumes will come out of any unused CAP supply and the next highest pool of water, which is called the Non-Indian Agricultural (NIA) priority pool (which actually supplies municipal and tribal uses), if needed. This scenario, with a Tier 1 shortage of 320,000 ac-ft, shows that the NIA priority pool will not be impacted through 2040. However, in reality additional shortage tiers and river conditions could occur and could bring reductions of larger volumes. These deeper reductions, combined with increasing demands in the other, higher priority CAP Municipal and Industrial (M&I) pool and the CAP Indian pool, could impact all of these pools in later years.

About 385,800 ac-ft of recovery occurs in the Normal Delivery scenario in the PAMA between 2016 and 2040; however, about 1.6 million ac-ft of the water projected to be stored in the PAMA during the projection period remains in storage under the assumptions described above. Under the Tier 1 Shortage Scenario, the same volume of recovery takes place, but the volume remaining in storage in the PAMA is less than 880,000 ac-ft. For more detail on supply assumptions used in these projections, please refer to ADWR's website: *http://www.azwater.gov/AzDWR/WaterManagement/AMAs/FourthManagementPlan.htm*.

11.5 RESULTS OF WATER BUDGET ANALYSES

For the historical period of 1985 through 2015, there were a few years where the water supply, based on net natural recharge into the PAMA, exceeded the volume of pumping (surplus years). Based on the assumptions described in this chapter, there are no surplus years in the projected period of 2016 through 2040. Both scenarios show overdraft in every year.

Tribal, municipal, and industrial CAP water uses are not affected under the Tier 1 Shortage Scenario. In the municipal sector, providers held sufficient long-term storage (LTS) credits to maintain their DAWS requirement of consistency with the management goal. ADWR did not assume any AWBA credit recovery in the Tier 1 Shortage Scenario.

The projection assumptions are based on a 167 percent increase in PAMA population, from 203,810 people within the AMA in the year 2015 to 543,419 people in the year 2040. The overall PAMA municipal provider GPCD rate, including large and small providers, declines by 10 percent, or about 0.4 percent per year, (from 172 GPCD to about 154 GPCD) from 2015 to 2040. The scenarios also assume that use of CAP water increases over time by subcontract holders, but not all subcontract holders use their CAP water during the projection period. In addition, it is presumed that NIA priority CAP reallocation water will be available for use beginning in the year 2017, and will be fully utilized in the PAMA when available.

In the Normal Delivery Scenario about 1.5 million ac-ft of CAP water is stored at GSFs, and over 286,000 ac-ft of reclaimed water is stored at USFs in sum for the 24-year projection period from 2016 through the year 2040 *(See Figure 11-1)*. These figures are based on current permit limits and ADWR AWS determinations and legal authorities and policies currently in place. The budgets are based on approximate conservation and augmentation goals and are not intended to suggest limitations on individual water users or sectors.

Storage of CAP water is much less in the Tier 1 Shortage Scenario. In this scenario, only about 1.1 million ac-ft of CAP is stored at GSFs. (Storage of reclaimed water is identical to the Normal Delivery Scenario.)

In the projection years, 2016 through 2040, the water balance varies year to year depending on the fluctuating natural condition assumptions as shown in Table 11-1, but the continued groundwater withdrawals result in continued overdraft in both scenarios for the PAMA. Continued water level declines lead to loss of physical availability for new applications for AWS.

Because the water table is greatly affected by localized recharge and withdrawal, there may be areas within the PAMA where localized groundwater declines will result in land subsidence, wells going dry, increased pumping costs, and water quality changes. Conversely, the benefits of recharge may be confined to areas where agricultural pumping has lessened or been discontinued due to the use of renewable supplies or in-lieu CAP water. Addressing the impacts of local water level declines and recoveries in subareas of the PAMA will be an ongoing challenge for water management as the fourth management period proceeds.

TABLE 11-1
PINAL AMA HISTORICAL & PROJECTED
NET NATURAL RECHARGE, 1985 – 2040 (ac-ft)

Year	Net Natural Recharge	Mountain Front	Streambed	Groundwater Inflow	Groundwater Outflow
1985	241,133	500	179,173	84,615	23,155
1986	105,184	500	43,328	82,378	21,021
1987	85,468	500	20,026	84,998	20,056
1988	92,200	500	25,059	85,678	19,037
1989	84,810	500	17,145	85,454	18,288
1990	103,876	500	38,021	83,760	18,405
1991	109,920	500	42,700	83,981	17,261
1992	221,483	500	157,597	82,423	19,037
1993	706,257	500	645,532	87,720	27,494
1994	84,918	500	18,227	89,091	22,899
1995	152,950	500	85,969	88,211	21,730
1996	85,909	500	16,529	89,074	20,193
1997	74,321	500	5,624	87,481	19,285
1998	99,660	500	32,413	85,124	18,377
1999	82,994	500	15,886	83,928	17,320
2000	117,955	500	50,373	84,429	17,347
2001	70,119	500	5,309	80,688	16,378
2002	81,132	500	13,971	83,174	16,514
2003	88,547	500	21,807	82,284	16,044
2004	97,231	500	27,934	84,845	16,049
2005	123,685	500	57,383	81,115	15,313
2006	196,491	500	131,579	80,699	16,286
2007	103,258	500	39,056	79,335	15,633
2008	102,289	500	35,770	81,881	15,862
2009	80,940	500	14,573	81,046	15,178

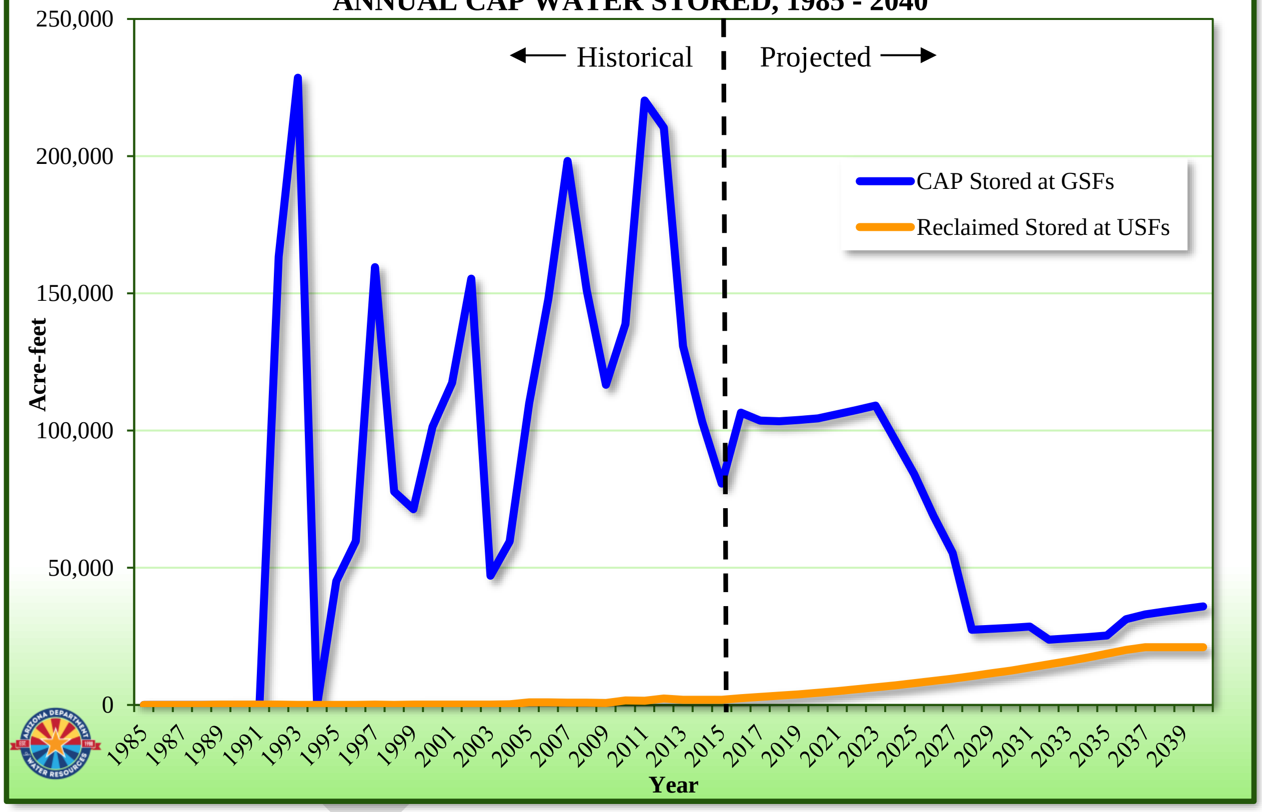
Year	Net Natural Recharge	Mountain Front	Streambed	Groundwater Inflow	Groundwater Outflow
2010	129,624	500	68,849	75,022	14,747
2011	84,280	500	22,839	75,153	14,212
2012	80,281	500	18,260	75,223	13,702
2013	89,906	500	26,023	76,891	13,509
2014	83,831	500	21,263	75,596	13,528
2015	74,885	500	12,226	75,343	13,185
2016	*67,181*	*500*	*5,622*	*74,671*	*13,611*
2017	*94,579*	*500*	*32,420*	*75,425*	*13,766*
2018	*78,074*	*500*	*15,901*	*75,494*	*13,821*
2019	*111,641*	*500*	*50,359*	*74,863*	*14,081*
2020	*66,885*	*500*	*5,323*	*75,071*	*14,009*
2021	*75,553*	*500*	*13,924*	*75,127*	*13,998*
2022	*83,622*	*500*	*21,845*	*75,216*	*13,939*
2023	*89,781*	*500*	*27,910*	*75,263*	*13,892*
2024	*119,928*	*500*	*57,362*	*76,056*	*13,990*
2025	*193,539*	*500*	*131,570*	*76,437*	*14,969*
2026	*102,315*	*500*	*39,033*	*77,410*	*14,628*
2027	*100,017*	*500*	*35,786*	*78,342*	*14,611*
2028	*80,102*	*500*	*14,551*	*79,599*	*14,549*
2029	*134,841*	*500*	*68,919*	*80,274*	*14,852*
2030	*151,772*	*500*	*86,000*	*80,470*	*15,198*
2031	*84,011*	*500*	*16,510*	*81,854*	*14,853*
2032	*74,319*	*500*	*5,622*	*82,757*	*14,560*
2033	*101,627*	*500*	*32,420*	*83,214*	*14,507*
2034	*85,397*	*500*	*15,901*	*83,251*	*14,255*
2035	*119,656*	*500*	*50,359*	*83,020*	*14,224*
2036	*75,458*	*500*	*5,323*	*83,495*	*13,860*
2037	*84,655*	*500*	*13,924*	*83,938*	*13,708*
2038	*93,348*	*500*	*21,845*	*84,459*	*13,457*
2039	*100,102*	*500*	*27,910*	*84,903*	*13,211*
2040	*130,358*	*500*	*57,362*	*85,502*	*13,006*

Many of the 1980 Groundwater Code (Code) provisions are designed to assist the PAMA in achieving its water management goal. These include mandatory conservation requirements, the AWS Program, AWBA excess CAP water storage, and incentives for use of renewable supplies. There are a number of factors that affect achievement of the PAMA goal that are not under ADWR's control. Many of these factors relate to economic conditions while others relate to water pricing, municipal growth, changes in land utilization, and industrial demand.

ADWR will evaluate whether there is potential for additional conservation measures for inclusion in the Fifth Management Plan. Regardless of the stringency of conservation requirements, groundwater will continue to be pumped to meet the demand associated with grandfathered rights under the Code. Continued uses of groundwater could result in further depletion of groundwater supplies.

The AWBA has stored a significant volume of excess CAP water, which will be made available to municipal and industrial (M&I) priority subcontractors and fourth priority on-river M&I users during declared shortages on the Colorado River. During the fourth management period, the AWBA may recharge CAP and extinguish the associated credits to provide water to the aquifer itself. Another possible future strategy could be to increase the groundwater withdrawal fees, which could be used to purchase and recharge CAP water and extinguish the credits.

FIGURE 11-1
PINAL AMA HISTORICAL & PROJECTED
ANNUAL CAP WATER STORED, 1985 - 2040



The ultimate capacity for CAP recharge in the PAMA depends on multiple physical, economic, and political variables. Pricing of CAP water is controlled by the Central Arizona Water Conservation District (CAWCD) board and is slated to increase with time. The volume of available CAP water either for direct use or for recharge and recovery depends upon whether the US Secretary of the Interior declares a shortage on the Colorado River, per the 2007 Record of Decision on the Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead. Other diverse factors will affect the PAMA water use in the future. Chief among these is the commodity prices for crops grown.

Beyond the year 2025 and into the latter part of the next century, it is anticipated that some general trends in water supply and demand could appear. Agricultural demand is not projected in either scenario to decline significantly, however some reduction in agricultural demand due to urbanization is likely to occur during the projection period. Conversely, municipal and industrial demands are likely to increase, but still remain only a small fraction of the total PAMA demand.

Long-term water use decisions made by municipal water providers who hold a DAWS will be driven by the need to meet AWS Program requirements. These decisions relate to the use of allowable mined groundwater, recharge and recovery of CAP water, recharge and recovery of reclaimed water, and possible acquisition of additional CAP allocations. The physical availability of groundwater may increasingly affect water management decisions in the future. Declining groundwater levels could make recovery of CAP or effluent credits through groundwater pumping difficult or impossible in some areas of the basin. ADWR's computer model will be a valuable tool for evaluating the possible effects of various recharge and pumping scenarios inside the PAMA.

11.6 CONCLUSIONS

During the third management period agricultural water demand in the PAMA fluctuated, and did not demonstrate a clear increasing or decreasing trend. At the same time PAMA population, municipal demand and industrial demand increased, and tribal use of CAP water for agriculture increased. The result was that overdraft continued and annual groundwater use in the PAMA was not reduced. The water budgets presented here indicate that given these assumptions and recent population projections, groundwater overdraft is projected to continue in the PAMA in the fourth management period.

Water budgets are useful planning tools when viewed in the long-term planning context. Water management decisions made in the next 10 years should increasingly reflect the need to balance current demands with the anticipated needs of future water users. The PAMA historical water budget will continue to be updated throughout the fourth management period as new data and water use plans become available. Water budget updates will be coordinated with ADWR's hydrologic modeling efforts so that changes in supply and demand can be understood in terms of their impacts on water levels in the PAMA. In this way, the historical and projected water budgets will continue to be a key tool in understanding the progress the PAMA is making toward achieving its goal.

APPENDIX 11
DELIVERY SCHEDULE THROUGH 2040

Year	CAP Delivery Supply (includes P4 and P3 (68,400))	Tier 1 Shortage Supply
2014	1,500,000	1,500,000
2015	1,500,000	1,180,000
2016	1,538,785	1,218,785
2017	1,537,841	1,217,841
2018	1,536,912	1,216,912
2019	1,535,999	1,215,999
2020	1,529,508	1,209,508
2021	1,528,372	1,208,372
2022	1,527,251	1,207,251
2023	1,526,148	1,206,148
2024	1,525,059	1,205,059
2025	1,523,988	1,203,988
2026	1,522,934	1,202,934
2027	1,521,898	1,201,898
2028	1,520,880	1,200,880
2029	1,519,882	1,199,882
2030	1,518,999	1,198,999
2031	1,518,290	1,198,290
2032	1,517,592	1,197,592
2033	1,516,907	1,196,907
2034	1,516,236	1,196,236
2035	1,515,579	1,195,579
2036	1,514,937	1,194,937
2037	1,514,308	1,194,308
2038	1,513,690	1,193,690
2039	1,513,086	1,193,086
2040	1,512,491	1,192,491

NOTE: The years 2014 and 2015 are not used in the table above. Instead actual deliveries from CAP are used. The first projection year is 2016, which is the first shortage year.

Bibliography

ADWR. (2011). *Demand and Supply Assessment 1985-2025, Pinal Active Management Area.* Phoenix.

AWBA, ADWR and CAP. (2014). *Recovery of Water Stored by the Arizona Water Banking Authority, A Joint Plan by AWBA, ADWR and CAP.* Phoenix: AWBA, ADWR, CAP.

Central Arizona Project. (2015, April 22). Shortage Impacts to CAP Priority Pools and Customers. Phoenix: CAP.

Luna B. Leopold, U. (1959). *Geological Survey Circular 410, Probability Analysis Applied to a Water-Supply Problem.* USGS.

Silver, N. (2012). *The Signal and the Noise.* The Penguin Press.